



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants : Judson Sharples; Kenneth F. Zacharias and Guy F. Hudson
Attorney Docket No. 500411.03
Serial No. : 09/843,293
Group Art Unit 3723
Filed : April 21, 2001
Examiner Eziamara Anthony Ojini
Title : METHOD AND APPARATUS FOR CONTROLLING PH DURING
PLANARIZATION AND CLEANING OF MICROELECTRONIC SUBSTRATES

DECLARATION UNDER 37 C.F.R. § 1.131

Sir:

I Judson Sharples, declare the following:

1. I am a named inventor on the above referenced patent application.
2. I have been employed as an engineer for Micron Technology since 11/8/1995.
3. Prior to August 1, 1997, I conceived of a method to enhance chemical mechanical planarizing (CMP) processes by maintaining a constant pH of the planarizing media during the entire CMP process, including the planarizing and ramp down steps, and using the same constant pH for the solution in the substrate rinse and the conditioning steps. I recognized that a substantial increase in effectiveness of the CMP process could be obtained by removing particulate matter from the substrate and the polishing pad under conditions where the pH was maintained between the various steps used in CMP.
4. Prior to April August 1, 1997, and within less than a month of conceiving the idea, we reduced the idea to practice by using solutions of a constant pH in the planarizing slurry, the substrate rinse and the pad conditioning solutions in a CMP process. Experimental data was taken, which established that maintaining a constant pH for the solutions used in these steps was effective in improving the quality of CMP processes.
5. Exhibit A, submitted herewith, is a copy of Invention Disclosure Statement No. 97.946, which was submitted to my employer, Micron Technology, Inc., which sets forth the foregoing inventive idea and which provides data showing actual results of various tests of actual embodiments thereof. The Invention Disclosure Statement was submitted

within a month after testing was concluded for the purpose of preparing the instant patent application.

6. The aforementioned statements based on my own knowledge are true and/or are based on information believed by me to be true. I acknowledge that willful false statements and the like are punishable by fine or imprisonment, or both, and may jeopardize the validity of the subject patent application or any patent issuing thereon.


Judson Sharples

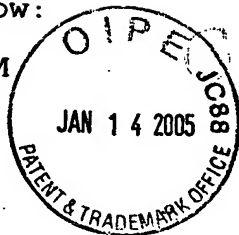
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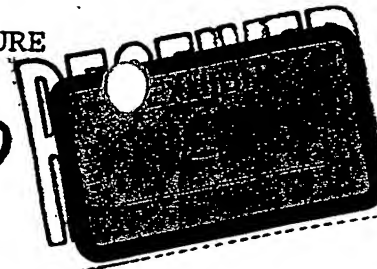
INVENTION DISCLOSURE

EWD

___ Advanced SRAM
___ BST
___ FED
___ FE RAM
___ NCAICM



97946



175

1. INVENTOR(S): Judson Sharples
Ken Zacharias
Guy Hudson

2. DESCRIPTION

2.1 Title of invention:
Constant pH CMP polishing process

2.2 Brief description:

Maintain a constant pH level throughout the polishing process using 1) a slurry-only process or 2) a slurry combined with a TMAH/DI water solution in order to reduce particles (colloidal polishing by-products) post polish. Both of the above processes use no "straight" DI water during the processing of the wafers.

2.3 Also attach a complete description, including drawings or sketches and articles relevant to the invention. Legible photocopies of laboratory notebooks are acceptable.

Originally, we used a polishing process that included DI water only in the rampdown of the process. We found that we could reduce particulate contamination post polish by removing the DI water from the process.

We can maintain a constant pH on the polishing pad during the polishing process by plumbing a TMAH/DI water solution by way of Pump 3 to the Head (MP). Slurry is used in the ramp-up and polishing cycle followed by the TMAH/DI water solution in the ramp-down, conditioning cycle, and buff step (secondary polish). The buff step combined with the constant pH processing works to reduce particles (colloidal polishing by-products) post polish.

Test results are attached. Summary of tests is below:

Project 602: Shows lower particle defects by using TMAH in the spray box of the IPEC polisher. (The wafers are placed in the spray box following the polish).

This project also shows reduced particle defects by using slurry only (no DI water) in the rampdown.

Project 590: Preliminary test showing lower defects with no DI in the rampdown.

Project 578: Preliminary test showing lower defects with the use of TMAH in the spray box.

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- Project . . . Shows lower particle counts when using TMAH on both the Fab 4 and Fab C cleaners.
- Project 512. Preliminary testing for TMAH in the spraybox. This experiment favored TMAH in the spraybox.
- Project 510: TMAH in the spraybox. Again, TMAH in the spray box reduces particulate contamination.

3. INFORMATION CONCERNING CONCEPTION OF INVENTION

3.1 CONCEPTION AND DOCUMENTATION OF THE INVENTION

- a. Identify the date when you first conceived the invention. (If not sure, give the earliest date of which you are sure.)

[REDACTED]

- b. To whom was the idea first described and on what date? (Other than a co-inventor.)

Wade Van Buren
Tom Melody
Larry Cook
[REDACTED]

- c. Identify the date of the first tangible record such as computer simulation, tape out, drawing or written description. Please specify type and location.

[REDACTED], RDA Project #510

3.2 CONCEPTION OF THE INVENTION

- a. Please identify related invention disclosures, patents or other publications describing similar ideas, and other companies working in the same field. Attach copies, if available.

N/A

- b. What is the closest technology, of which you are aware?

Standard polish on IPEC676 polisher.

- c. Identify the advantages of this invention over previous technology.

Reduction of particles (colloidal polishing by-products: post polish.

3.3 IMPORTANT DATES

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- a. Has the invention been disclosed outside the company? Yes
If yes, to whom, when, and in what form?

David Coffeen, IPEQ Site Coordinator

Assisted in plumbing TMAH to the tool.

- b. Have any articles describing your invention been published?
No If yes, list author(s), title of article, publication
and date.

- c. Have any engineering samples been given out? NO If yes, to
whom and on what date?

- d. Has any product using the invention been sold or offered for
sale? Yes If yes, to whom and on what date?

3.4 DISPOSITION OF THE INVENTION

- a. When will (or did) Micron begin use of the invention
experimentally?

4/5/1997

- b. When will (or did) Micron begin production of this invention?

9/11/1997

3.5 MISCELLANEOUS INFORMATION

- a. Was the invention developed during a joint development
agreement or other contract with an outside company? NO

- b. Please list developmental work outside of the company
(including Government proposal or contract).

N/A

4. INVENTORS:

Name: Judson, Sharples

Micron Phone: 85271 Micron Mail Stop: 550

Company Name (VERY IMPORTANT):

Dept. Name: Fab C CMP

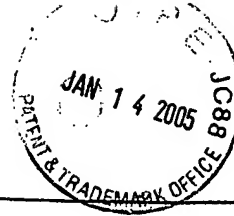
X Micron Technology, Inc.

Dept. #: 175

 Micron Electronics, Inc.

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☐ Micron Quantum Dev. ☐ S
☐ Micron Display Technology, Inc.
☐ Micron Communication, Inc.
☐ Other _____



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Dept. Name: FABC CMP

Dept. #: 175

☒ Micron Technology, Inc.
☐ Micron Electronics, Inc.
☐ Micron Quantum Devices
☐ Micron Display Technology, Inc.
☐ Micron Communications, Inc.
☐ Other _____

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Supervisor: TRENT WARD

Signature: Ken Zacharias Date: [REDACTED]

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Name: Guy Hudson

Micron Phone: 84706

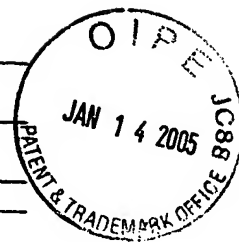
Micron Mail Stop: 550

Company Name (VERY IMPORTANT):

Dept. Name: CMP

Dept. #: 175

- ☒ Micron Technology, Inc.
☐ Micron Electronics, Inc.
☐ Micron Quantum Devices
☐ Micron Display Technology, Inc.
☐ Micron Communications, Inc.
☐ Other _____



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Citizenship: US

Supervisor: T. Melody

Signature: _____

Date: _____

-- If more than three inventors use additional form(s) available in the Legal Department, 3rd floor, Administration building. --

5. WITNESS

If there is only one inventor, a witness should sign and date this disclosure. A witness in this case is a non-inventor who understands the nature of the invention.

(Signature of Witness)

(Date)

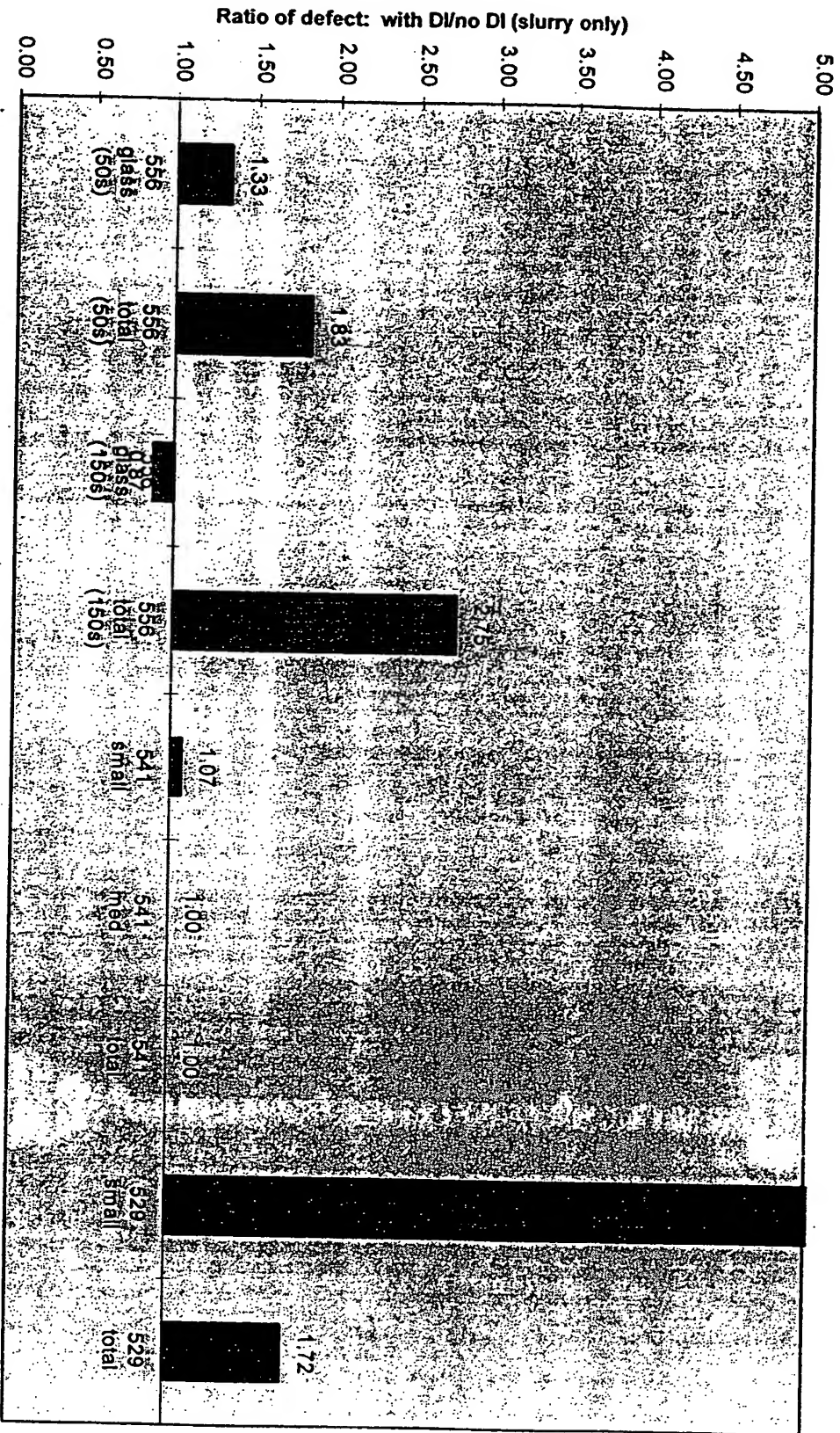
Note: If you have any questions or wish assistance completing this form, please call the Legal/Patent Department, ext. 4527.

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Project 602

Figure 2: Defects with/without DI in rampdown. Value > 1 favors no DI in rampdown.

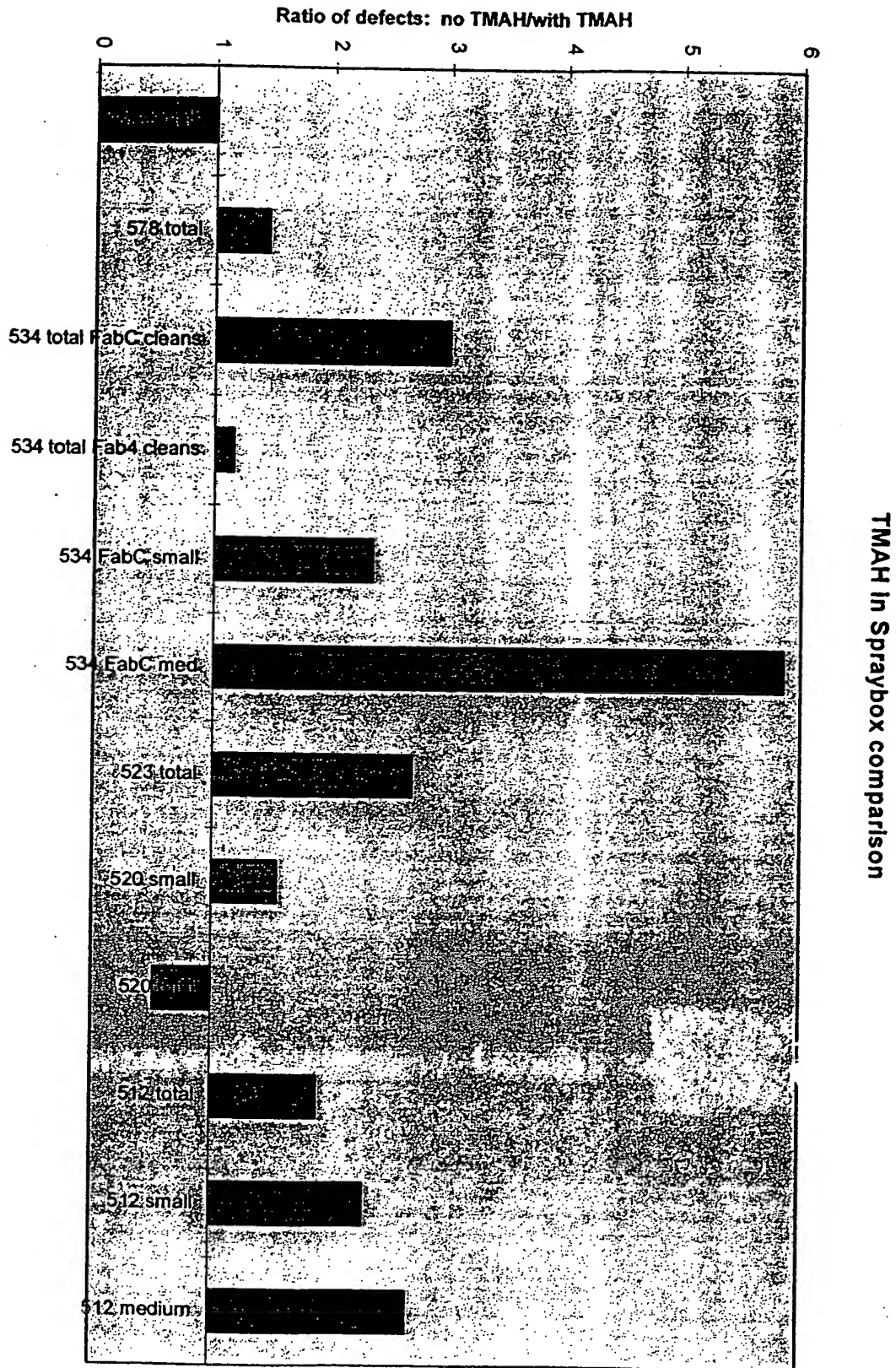
Defects with and without DI in rampdown



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Project 602

Figure 1: Project # and measured defects for TMAH in spraybox testing. Value > 1 favors TMAH in spraybox.



Project 590: Di on/off testing (topos/blankets with and without Ti dep)

Blankets post-polish on Surfscan:

- no DI in rampdown: median = 14.5 defects/wafer (one flyer at 85 defects)
- with DI: median = 18. defects/wafer

Project 578: TMAH vs. No TMAH (canister)

Purpose: Monitoring of particle performance with and without TMAH-IPEC 605

Results:

With TMAH: 1.38 defects/wafer

Without TMAH: 2.00 defects/wafer

Project 534: Cleans test on IPEC606

Purpose: Split new/old CCMP process with FabC/Fab4 cleans. Std. resist.

Test:

Group	Polish	TMAH	Cleans	small	medium	large	total
1	Old	No	FabC	19.2	32.8	0	65.4
2	Old	No	Fab4	18	8.2	0	44.6
3	New	Yes	FabC	8.2	5.6	0	21.8
4	New	Yes	Fab4	3.4	0.4	0	38.4

Project 512: TMAH vs. No TMAH in Spraybox

Purpose: The purpose of this test is to compare the Ipec container recipe with no TMAH and the Ipec 200 recipe with TMAH turned off for CMP scratches and the CMP related glass type defects.

Results: Glass type CCMP defects were a lot heavier on the group of wafers with the TMAH turned off. Small glass type particles were at least 2X larger on the No TMAH.

TMAH	small	medium	large	scratches	total
On	8	4.5	4	4.8	42.3
Off	18.3	12	11	3.7	80

Project 510: Slurry Flow in Rinse Steps II

TMAH on in spraybox.

flow	small	medium	large	total
0ml/min	4.3	35	35	187
50ml/min	2	7.3	1	17
100ml/min	3.7	1	0	9.3